NAVAL WAR COLLEGE
Newport, R.I.

OPERATIONAL CONCERNS OF DECONTAMINATION IN MITIGATING THE EFFECTS OF CHEMICAL AND BIOLOGICAL WEAPONS AGAINST SEA PORTS

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: _____

13 May 2002

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4

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED

2. Security Classification Authority:

3. Declassification/Downgrading Schedule:

4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT

6. Office Symbol: C

7. Address: NAVAL WAR COLLEGE
686 CUSHING ROAD
NEWPORT, RI 02841-1207

8. Title (Include Security Classification): OPERATIONAL CONCERNS OF DECONTAMINATION IN MITIGATING THE EFFECTS OF CHEMICAL AND BIOLOGICAL WEAPONS AGAINST SEA PORTS (U)

9. Personal Authors: Greg D. Olson, Lieutenant Colonel, US Army

10. Type of Report: FINAL

11. Date of Report: 13 May 2002

12. Page Count: 24

12A Paper Advisor (if any):

13. Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.

14. Ten key words that relate to your paper: chemical, biological, warfare, SPODs, vulnerability, threat, decontamination, doctrine, Joint, multinational

15. Abstract: Future adversaries could render power projection facilities inoperable through contamination from chemical and biological weapons (CBW) attacks making ineffective much of our current ability to project military power overseas. Seaports of debarkation (SPODs) are key nodes for introducing assets into the theater and are an operational center of gravity that can be a critical vulnerability if attacked by the enemy. They require careful protection and commitment of resources to ensure they are adequately protected and, if attacked, quickly restored to operation. Rapid and effective decontamination is an essential requirement requiring priority attention.

The ability to restore an SPOD to partial, if not full, operation may be critical to accomplishing rapid, efficient, and effective deployment of United States forces. Understanding critical vulnerabilities of SPODs to contamination and restoring them through decontamination remains a complex problem for operational commanders. Currently, existing United States military doctrine is deficient in providing operational level CBW decontamination capabilities and procedures. While there is no doubt that revolutionary change in decontamination technology is necessary, the operational commander needs evolutionary change and operational flexibility in joint doctrine, procedures, and responsibilities to meet the decontamination challenges in the face of emerging anti-access problems associated with the proliferation of CBW. Only through the consistency of Joint doctrine, will DoD improve operational decontamination capabilities timely and responsively in support of global force projection.

16. Distribution / Availability of Abstract:	Unclassified	Same As Rpt	DTIC Users
	X		

17. Abstract Security Classification: UNCLASSIFIED

18. Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT

19. Telephone: 841-6461

20. Office Symbol: C

Abstract of

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Future adversaries could render power projection facilities inoperable through contamination from chemical and biological weapons (CBW) attacks making ineffective much of our current ability to project military power overseas. Seaports of debarkation (SPODs) are key nodes for introducing assets into the theater and are an operational center of gravity that can be a critical vulnerability if attacked by the enemy. They require careful protection and commitment of resources to ensure they are adequately protected and, if attacked, quickly restored to operation. Rapid and effective decontamination is an essential requirement requiring priority attention.

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INTRODUCTION

International crises or threats to the United States national security interests requires the capacity to rapidly project United States forces into forward deployed bases or directly into the crises area. One of the six operational goals in the Department of Defense's (DoD's) transformation efforts is projecting and sustaining United States forces in distant anti-access or area-denial environments and defeating anti-access and area-denial threats.[1] Seaports of debarkation (SPODs) are key nodes for introducing assets into the theater and are an operational center of gravity that can be a critical vulnerability if attacked by the enemy. They require careful protection and commitment of resources to ensure they are adequately protected and, if attacked, quickly restored to operation. Unrestricted availability of these critical nodes are vital to successful operations, yet are ideal targets for chemical and biological weapons (CBW) use by threat forces. This anti-access asymmetric approach can deter, slow, or interdict the flow of forces and resources into the theater of operations, especially when relocation to another port is not possible, and effectively shut off the United States line of communication (LOC) pipeline to its forces. Consequently, countering this threat, through rapid, effective decontamination, is an essential requirement.

Existing United States military doctrine is deficient in providing operational level CBW decontamination capabilities and procedures. This paper will address the operational concerns of decontamination for mitigating the effects of CBW agents used against SPODs. The first portion of this paper will analyze past efforts to address chemical and biological contamination at critical force projection sites. Next, I will provide a general overview of the chemical and biological threat to port operations and the key considerations for assessing the critical areas of vulnerability in and around an SPOD to contamination. The remainder of the

paper will focus more narrowly on decontamination, examining where we are today and providing recommendations, based on certain operational criteria, for refining operational decontamination at SPODs. Recommendations will support Universal Joint Task List **(UJTL) Task # OP 6.2.8, "Establish Nuclear, Biological, and Chemical (NBC) Protection in the Joint Rear Area (JOA)".**[2]

BACKGROUND

There are three basic tenants to NBC defense: contamination avoidance, protection of individuals, units, and materiel, and decontamination in order to restore operational capability. Contamination avoidance includes chemical and biological reconnaissance, detection, identification, warning, and reporting. Protection includes individual and collective protection of personnel, measures to cover cargo and equipment, and mitigation of the effects of a chemical or biological attack. Decontamination involves those actions and procedures necessary to reduce or eliminate chemical and biological hazards after an attack. The three tenants are mutually supporting. In cases where ports may not take full advantage of protection and contamination avoidance techniques, decontamination of key nodes may provide the most effective way to restore throughput capability.

Joint Publication 3-11, Joint Doctrine for Operations in Nuclear, Biological, and Chemical (NBC) Environments provides top level guidance to the Commanders in Chief (CINCs).

> "The worldwide availability of advanced military and commercial (including dual-use) technologies, and commonly available transportation and delivery means, may permit adversaries to develop and employ NBC weapons and other toxic materials within a regional area of conflict and beyond. Moreover, adversaries not party to an ongoing conflict may seize that opportunity to hold United States interests at risk for their own purposes, perhaps at locations beyond the region of conflict including the United States homeland."[3]

However, it fails to address the Joint and/or Service responsibilities for providing chemical and biological decontamination capability to critical rear-area facilities such as SPODs, aerial

ports of debarkation (APODs) and logistics bases. During the same period, several studies were undertaken to determine the impact of CBW agent contamination on these sites. First, the Joint Staff J-5, issued a 1995 study, Mitigating the Effects of Biological and Chemical Warfare Agents on Sea and Aerial Ports of Debarkation, which attempted to identify potential issues while operating in a contaminated environment.[4] This study focused primarily on the NBC defense tenant, protection. Next, in 1996, the United States Air Force conducted a study to determine the effects of CBW on air base operations, which again focused on protection and contamination avoidance.[5] In 1998, Joint Staff, J-8 conducted the Joint Weapons of Mass Destruction Analysis to study medical concerns in a chemical and biological weapons environment.[6] In 2000, the RAND Corporation conducted a study: Countering Chemical and Biological Weapons, in Bahrain as part of the Desert Breeze series.[7] These studies built off studies and exercises from the 1980's and early 1990's including, Combined Arms in a Nuclear/Chemical Environment (CANE), DO-49 testing, and SALTY DEMO exercise. The significant finding of all these studies indicates a significant impact on personnel performance and logistics when wearing protective gear. In particular, the throughput rates of critical supply/debarkation hubs are severely hampered when operating in a contaminated environment which requires that protective gear be worn.

What has been missing is a study or simulation aimed to validate the key issues of previous studies to determine the impact on operations at critical sites with specific focus on decontamination. The study or gaming simulation design should place decontamination issues in an operational context from small scale contingencies to major theater conflict at APODs, SPODs, and forward logistics bases. Although such an event has not taken place, examining the threat, vulnerability assessment, and improvements in decontamination will

increase operational warfighting capabilities through improved warning and decontamination capabilities at SPODs, thereby minimizing the impact of a CBW attack on the flow of forces.

THREAT

Given proliferation of CBW and their potential relative ease of use, planners should expect that potential adversaries would employ these weapons against United States forces in the future. A force projection based military is vulnerable to smaller-scale use of CBW within a Joint battlespace that includes ports of embarkation and debarkation necessary for any power projection. Our enemies will attempt to neutralize our strengths by asymmetric means to prevent United States forces from building massive combat power while trying to inflict high casualties. In studies, SPOD degradation from CBW fluctuates between 23% and 100% on temperatures between <50 F through >84 F.[8] Potential adversaries, including state and non-state actors, also may seek to acquire clandestine and long-range delivery systems and CBW capability that can reach beyond their geographic regions. The senior leadership of the United States Government has embedded this concern in a number of policy statements. The 2003-2007 Defense Planning Guidance (DPG) states,

> "the threat or use of chemical and biological weapons is a likely condition of future warfare, including the early stages of war. Such weapons could be employed by hostile forces as a means of disrupting United States operations and logistics. United States forces will be prepared to fight and win in a chemically or biologically contaminated environment. The Services will also continue to improve chemical and biological detection and decontamination capabilities at ports and airfields."[9]

The 2000 United States Security Strategy states, the United States must be prepared to fight and win where *asymmetric means* are used against us... Such as WMD ...*used to disrupt the critical logistics pipeline* from its origins in the United States ...to its termination at *seaports in theater*.[10] Further related comments can also be found in Joint Vision 2020.

SPODs present a particularly inviting target for CBW. Large, fixed sites at which United States forces will concentrate, if only temporarily, offer an enemy a strategic and

operational target relatively easy to strike using a wide range of chemical and biological agents and delivery systems. While the precise threat to each SPOD will be unique to the specific location, time, and situation, some generalizations can be made.

Chemical weapons will remain the most likely threat for the foreseeable future. Relatively easy to produce and already in the hands of many potential enemies of the United States, these weapons can be employed using a variety of means, to include ballistic and cruise missiles, aircraft (manned and unmanned), special operations forces, and terrorists. Included in the chemical threat are toxic industrial chemicals (TICs) and toxic industrial materials (TIMs). TICs and TIMs defined as those industrial chemicals and materials that can be transported to or are stored in the vicinity of an SPOD and normally used for industrial or commercial purposes, but which can be every bit as dangerous as military chemical agents can. Because they may be already located in the area or are locally available, transport and storage facilities for these materials represent a particularly inviting target for terrorist or special operations forces and they can do considerable damage to an SPOD.

Biological agents pose another insidious threat to SPODs and are potentially far more disruptive than chemical agents. Fundamentally different than chemical agents in their properties and effects, biological weapons can also be delivered by a variety of means, including missiles, aircraft, special operations forces, and terrorists.

VULNERABILITY ASSESSMENT

Development of chemical and biological defense plans requires not only an understanding of the threat, but also a clear assessment of the port's unique capabilities, requirements and vulnerabilities. Loss or degradation of an SPOD could seriously disrupt

force deployment schedules of a major operation or campaign plan. The ability to restore an SPOD to partial, if not full, operation may be critical to accomplishing rapid, efficient, and effective deployment of United States forces. SPOD defense plans, developed by the Port Commander and managed by the Joint Rear Area Coordinator (JRAC), are designed across the full spectrum of military operations, considering the specific threat and role of the port during execution of the operational plan.[11] This then becomes part of the Base and Base Cluster defense plans and is integrated into larger, theater defense plans.

Assessing the vulnerability of a port is a systematic approach combining the understanding of the threat with analysis of the characteristics of a port to identify an SPODs specific vulnerabilities. Three areas must be considered in conducting a vulnerability assessment: port operational requirements and capabilities, threat assessment, and interaction with the host nation and other coalition partners.

Before assessing the potential impact of CBW, operational planners must first understand how ports operate, their key nodes and critical vulnerabilities, and the specific characteristics of a port. In analyzing the capabilities of the port, the planner factors in the projected flow of forces through the port and the effects a CBW attack could have on that flow. Critical is the identification of those key nodes that must be protected or restored to operation in order for the port to regain operational effectiveness.

Each port has a throughput process specifically designed to make efficient use of the facilities and equipment available. Consider the case of a general cargo port, which handles roll on/roll off (RO/RO), containerized, and break bulk cargo. A cargo port represents a complex network, with cargo proceeding from ships, through the pier, storage, marshaling, and then to port clearance on trucks or trains. As the cargo makes its way through the port,

specialized equipment or critical nodes (berths, ramps, cargo handling equipment (CHE), material handling equipment (MHE)), come into play, that, if not protected or restored to operations, can quickly debilitate the port's ability to conduct operations.

Ships arrive at the port in accordance with the theater deployment plan. Once moored or berthed, the ship is prepared for offload. Depending on the type of ship, this could involve lowering ramps and opening cargo bays and hatches, and exposing holds and decks. These actions can make the ship and its interior increasingly vulnerable to CBW contamination. During cargo offload, the ship's crew is responsible for access and for operating shipboard equipment (cranes, hydraulic doors, and ramps). Stevedores operate MHE and CHE from the pier side to unload bulk and container cargo staged on the pier. Depending on the type of ship and facilities at the port, this entire process can take up to several days during which time, both the ship and the personnel unloading it, are vulnerable to attack. Loss of substantial numbers of stevedores, offload personnel, and especially skilled operators of handling equipment and cranes could seriously degrade port operations. Once removed from the ship, cargo moves or is transported to designated marshaling sites, preferably outside of the immediate offload areas of the port, where the receiving unit makes the equipment ready for combat. This may take up to several days, usually in open areas for ease of organization and preparation, so it too presents a vulnerable target to CBW attack and contamination.

Having identified the key nodes and vulnerabilities of an SPOD, the next step lies in understanding the CBW threat by applying the threat assessment to the key nodes and potential vulnerabilities. The threat assessment consists of three parts: identifying the chemical and biological agents that can be employed by an enemy, determining the means of

delivery, and analyzing probable effects of an attack and should focus on the types of attacks most likely to occur at that particular port.

The specific threats to an SPOD must be determined based on the most recent intelligence analysis. This process is reevaluated and updated continuously to account for advances in technology, worldwide proliferation and presence of TICs/TIMs in the port area.

Delivery systems vary with respect to the capabilities of the enemy, location of the port, and type of agent to be employed. Each delivery means has capabilities and limitations. Missiles can deliver a large amount of chemical and disperse it over a large area, but targeting inaccuracies and uncertainties in wind speed and direction could cause the agent to miss the intended target. Aircraft can deliver large amounts of chemical through bombs or spray tanks, but may have difficulty penetrating integrated air defenses. Although SOF or terrorists can directly employ small quantities of CBW agent, they can have greater effect by damaging toxic chemical storage facilities, delivery trucks and railcars, or pipelines. An enemy may attempt more than one delivery means; a terrorist attack coupled with a ballistic missile attack can present two asymmetric threats using two different agents, greatly compounding port defense problems.

Finally, threat assessment should postulate the probable effects of an attack, not just in terms of contamination, but on the ability of the port to conduct operations. Chemical agents react with different materials in different ways, resulting in specific hazards and risks. Port materials vary from hard metal surfaces, such as ships and cranes, to soft materials, such as protective canvas covers, plastic-covered (shrink-wrapped) equipment and supplies and rubber fenders. Concrete and asphalt such as piers and wharves represent a large proportion of port surfaces. Some contaminated materials will remain a hazard for an extended period,

while others will not. Some materials absorb chemical agents quickly, reducing the contact hazard, but prolonging the vapor hazard. The variety and distribution of these surfaces across a port complicates the problem of defining effects.

Host nation and civilian support are key to successful port operations. In many cases, especially early in a deployment, logistical throughput operations at SPODs rely on host-nation facilities, workers, and host-nation forces to provide security and force protection. These elements can be vulnerable to a chemical and biological attack due to inadequate CBW defense training or shortages in CBW defense equipment. United States forces rarely control many of the capabilities necessary to operate the port. For some ports, civilian labor is essential to effective operations of a port. The vulnerability assessment must consider the role of the civilian workforce, identify the effects of their loss, and then determine how to either protect this critical capability or plan for replacements should they become casualties or refuse to work in a hostile CBW environment.

Blockage of transportation network chokepoints may cause significant delays or stoppages of vehicle and equipment movement through and out of the port causing congestion in staging areas and along roads and rails, severely limiting additional throughput, and exposing deploying forces to further attack. Of particular concern, many SPODs typically are located near populated areas or in heavily industrialized districts. While CBW effects may not directly impact port operations, civilian casualties, panic, road networks clogged with fleeing citizens, and political unrest may seriously degrade port operations and throughput. For these reasons, the vulnerability assessment must consider the risks to surrounding civilian populations and host nation civil defense and consequence management plans and capabilities.

DECONTAMINATION

Decontamination methods and technologies have not kept up with the various roles and missions of the Joint force. Current decontamination capability is labor intensive and logistically burdensome. This is based on the use of corrosive and harsh decontaminants and the need for access to large amounts of water. Currently fielded systems, such as the M17 Lightweight Decontamination Senator, the M12 Power Driven Decontamination Apparatus, the M13 Decontamination Apparatus, and the M21/M22 Modular Decontamination System, and ongoing decontamination research and development and operational concepts studies do not adequately address chemical and biological weapons defense vulnerabilities. Other shortcomings and challenges associated with current decontamination systems are the limited ability to decontaminate sensitive equipment, vehicle interiors, terrain, and the resumption of operations at contaminated ports and airfields supporting deployment and sustainment operations.

DoD's executive agent for CBW defense programs, including decontamination, is the United States Army.[12] The established doctrinal principles for decontamination are first, decontaminate as soon as possible; second, decontaminate only what is necessary; third, decontaminate as far forward as possible; and fourth, decontaminate by priority.[13] Existing doctrine is deficient in providing operational level CBW decontamination capabilities and procedures. Current doctrine fails to delineate the responsibilities for Joint and multinational facilities and the equipment and supplies transiting through. Each component commander is responsible for his own decontamination.

Regional OPLANs consider Reception, Staging, Onward Movement, and Integration (RSO&I) as a determining factor for a successful operation. United States Transportation

Command, a functional component commander with no CBW decontamination assets, is tasked with the operation of all SPODs.[14] SPODs and RSO&I staging areas, which are functionally assigned and not under Service component control, are omitted in the planning and force requirement process with respect to decontamination.

RECOMMENDATIONS

The following recommendations are offered to improve the operational capability Of United States forces regarding SPOD decontamination. Each will be analyzed across five major operational criteria, policy, doctrine, resources, materiel/logistics, and training. Policy is top-level guidance developed and issued by DoD, Joint Staff and Services. This policy is then implemented as doctrine derived at the Joint Staff to Operational level giving the operator the tools to carry out their mission. Resources involve the funding and force structure issues addressed at OSD, Joint Staff, CINC, and Services. Materiel/logistics involves materiel acquisition defined by the Joint Service Integration Group and developed by Joint Service Materiel Group, and logistical issues developed by the Joint Staff and Services. Training includes CINC exercises.

A. The Joint community must validate requirements for decontamination and contamination control procedures at large fixed sites, such as SPODs.

1. Discussion. While the ultimate goal is contamination avoidance or to move SPOD functions to uncontaminated areas, this may not be an option and the site must restore its operational capability. Moreover, specific required capabilities for fixed site decontamination are not straightforward. The ability to decontaminate the entire large area of a port is not possible within current technological and logistical capabilities. It is more likely that critical elements of a large area may be decontaminated to continue operations,

either fully or at some acceptable lower level. The requirement must also specify the required level of decontamination or if only contamination control procedures should be implemented. Further, the requirement should specify pre-attack preparations to mitigate effects of contamination, capability to detect and plot contamination, and decontamination parameters.

2. Operational criteria.

a. Policy. Address large area decontamination requirements with our allies to include host nation support, lease of facilities/equipment, and defining decontamination standards. We must undertake proactive and appropriate planning to address such issues because the use of allied port infrastructure is key to United States military strategy. For example, can a ship decontaminated with current capability be allowed to dock at an allied port? Provide guidance to address what is allowable for the environmental impact of decontamination.

b. Doctrine. Identify the requirement for large area decontamination across the Joint community. While all Services have a core capability to decontaminate their personnel and equipment, site infrastructure capability is not addressed. Being very-scenario dependent further complicates this issue. Joint exercises as a tool to further define and validate specific requirements for materiel, doctrine, and training development and to determine appropriate force levels.

B. Assign responsibility for decontamination of large fixed sites (SPODs) across all Services and institute appropriate force structure levels. The CINC needs the ability to deploy existing decontamination resources to appropriate locations in sufficient quantity to conduct restoration operations.

1. Discussion. Current responsibility for decontamination of individual United States military personnel and unit equipment is relatively clear; however, the decontamination of other personnel, equipment, and infrastructure at large fixed sites is undefined. The Military Traffic Management Command (MTMC) is responsible for operating SPODs, but they are not tasked, organized, staffed or equipped to carryout decontamination tasks. The issue is further complicated in that base ownership may belong to a third country, or shift from one Service to another during the build-up stage of RSOI. Service responsibility and ownership may also vary from CINC to CINC. On the force structure side, the Army has been sizing its decontamination force structure to support the ground component warfighter and shifting the decontamination capability to the reserve components over the past 10 years. Currently, only the Army has a chemically trained force structure capable of responding to a situation involving CBW attacks and restore operations. The imbalance between active and reserve component capabilities could result in potential delays in implementing Presidential Selected Reserve Call-up or mobilization and in making sufficient quantity of trained reservists available to the CINCs. Service components have also failed to articulate their decontamination support requirements. If decontamination assets are not in place prior to contamination, the decontamination process and the routes of supply flow could be severely impacted and restricted. Evacuating civilian personnel may block roads leading into the port, potentially spreading contamination and increasing the hazard area. Trucks or aircraft may not be available in sufficient quantity to positively impact the outcome of the situation.

2. Operational criteria.

a. Policy. Clearly define the question of mission responsibility at the highest levels of the DoD. The programmatic issue (personnel and equipment resources) on Services designated to provide decontamination support would be significant, but whether a Joint force or individual Service responsibility, decontamination capability must be in place when needed by the CINCs. Complete a comprehensive assessment to determine appropriate decontamination force structure requirements to ensure a proper mix of active and reserve forces combined with an appropriate sensitivity to the impact of a mobilization or call-up. Policy must support host nation, coalition, and third country national workers supporting United States forces and address training and unit availability.

b. Doctrine. Joint doctrine will play a key role in assigning responsibilities to commanders for CBW decontamination and those that accrue to component commanders through the service administrative chain of command. The CINCs must coordinate and prioritize decontamination capability throughout the theater of operation. The CINCs need planning tools to adequately support SPOD decontamination. CINCs must review their OPLANS and Time Phased Force Deployment Data (TPFDD) to determine core decontamination capabilities of available units used in restoration operations and insure they are available on the initial day of any potential situation that may involve CBW. Develop the appropriate mix of pre-positioned decontamination capability with spares, stocks, and reserve. Given today's current decontamination capability, it is fiscally unrealistic and logistically impractical to have sufficient quantities at every site. In addition, former Warsaw Pact countries, which are today members of NATO, may have important lessons learned and improved decontamination methods, equipment, and training that the United States should review.

c. Resources. Outfit units assigned responsibility for large-scale decontamination with appropriate equipment and training. CINC level assets may also need to be procured and maintained.

d. Materiel/Logistics. The ability to efficiently reinforce a contaminated base with decontamination equipment is essential. Logistics planning must develop strategies to rapidly re-supply decontamination solutions and equipment to a contaminated base and include cross-contamination prevention. This may include the ability to air drop supplies or development of new decontaminants and decontamination techniques.

e. Training. Conduct Joint exercises to validate procedures for flowing materiel into a contaminated port. Consider the integration of host nation, third country workers, and coalition forces. Focus on annual port assessments, then command post exercises (CPX) and terrain walk without troops every 18-24 months.

C. Define Joint operational and environmental decontamination standards for "contaminated or decontaminated" across the Joint community.

1. The determination of what is "clean" and what is "dirty" has major operational impacts on the execution of wartime operations. Since Desert Storm, there has been significant efforts undertaken to determine low-level or cumulative exposure standards for personnel exposed to even low levels of contamination and its impact on wartime and postwar use. The President's Committee on Gulf War Veterans' Illnesses has criticized DoD for not having objective standards for assessing whether a chemical agent is present or not and that a consistent, objective standard based on a verifiable process and criteria is essential.[15]

2. Operational criteria.

a. Policy. Address environmental and operational standards. There are significant implications on remediation of equipment and infrastructure from any standard adopted. Any standard proposed or adopted must first be measurable in the field; it cannot be laboratory standard. There must be an unambiguous statement of what constitutes "contaminated" and what "clean" means in absolute terms to ensure acceptance of DoD standards across all Government agencies and in the international community. An effort must be undertaken to clearly define these standards for operational use related to some clearly defined level of risk to personnel.

b. Doctrine. Develop clear guidance/awareness across the Joint community. The Air Force definition of the meiosis hazard is at least an order of magnitude lower than the other Services. Jointness requires similar standards. Develop risk assessment tools based on these standards to determine the threat posed by contamination. Additionally, address the disposition of contaminated supplies and equipment during and after conflict.

c. Materiel/Logistics. The lack of standards hinders the materiel developer in development of both detection equipment and decontamination capabilities. Without, materiel developers are designing programs, which may require redirection; this may delay fielding and increase costs. Additionally, being unable to determine which supplies pose health concerns severely impacts logistics flow to the warfighter and significantly hampering logistics.

CONCLUSION

Mitigating the effects of a CBW attack against SPODs is a complex problem posing unique challenges for the planning, operations, logistics, and force development

communities. While everybody recognizes the existence of a CBW threat and numerous studies have analyzed the contamination avoidance and protection principles of NBC defense, decontamination of SPODs remains unfocused and unresolved. While there is no doubt that revolutionary change in decontamination technology is necessary, the operational commander needs evolutionary change and operational flexibility in Joint doctrine, procedures and responsibilities to meet the decontamination challenges in the face of emerging anti-access problems associated with the proliferation of CBW. The objective of my recommendations is to gain the best relative competitive advantage for the CINC at the least cost in human life and equipment resources. Although equipment and funding remain important, only through the consistency of Joint doctrine, will DoD improve operational decontamination capabilities timely and responsively in support of global force projection.

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